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Large-Eddy Simulation in Complicated Domains using the Finite Element Method

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We demonstrate that the finite element method (FEM) in combination with large-eddy simulation (LES) provides a viable tool for the study of three-dimensional (3D), transient, turbulent flows that exhibit complicated vortex shedding patterns. The flow fields are calculated using a finite element spatial discretization of the incompressible Navier-Stokes equations. With our FEM approach, the discrete pressure Poisson equation is solved, so that continuity and momentum are decoupled and an explicit time-integration scheme is used. For this demonstration, we considered flow over a backward-facing step at a Reynolds number of 10,000 for both 2D and 3D simulations. The wealth of data generated in our LES is demonstrated by flow visualization.